PATENT

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Applicant:	BOYLE	Examiner:	Duong, D.
Serial No.:	10/563,649	Group Art Unit:	2821
Filed:	January 6, 2006	Docket No.:	GB030108US
Title:	COMMUNICATION DEVICE AND AN ANTENNA THEREFOR		

INVENTOR DECLARATION (UNDER 37 C.F.R. §1.131)

I hereby state and declare that I, Kevin Boyle, am an inventor of the subject matter described and claimed and for which a U.S. Patent is sought on the invention entitled: COMMUNICATION DEVICE AND AN ANTENNA THEREFOR, having U.S. Patent Application Serial Number 10/563,649 (Docket No. NXPS.410PA), filed on January 6, 2006, which claims priority to Great Britain Application Number 0316169.2, filed on July 10, 2003.

I, Kevin Boyle, further state that:

1. The invention claimed in the above-referenced application was conceived of before June 13, 2003 as is evidenced by a copy of a three-page document entitled "Multi-band RF Modules" (attached to this Declaration and labeled for this submission as Exhibit A), which is dated (the actual date having been redacted) prior to June 13, 2003. I worked with an Attorney in preparing a patent application (which was filed as Great Britain Application Number 0316169.2) from prior to June 13, 2003 until its filing on July 10, 2003.

2. Regarding the independent claims (*i.e.,* claims 1, 7 and 12), Figures 2 and 3 (and the related discussion) on pages 2-3 of Exhibit A show correspondence to the claimed invention, for example, as follows: an RF("radio frequency") circuit connected to an antenna by a self supporting member that has at least one feed pillar and a shorting pillar; the pillars are connected to respective contact points of the RF circuit (*see, e.g.,* sections c. and d. beginning on page 2 of Exhibit A); and the pillars extend from the RF circuit to an antenna interface that is

connected to the antenna by a pressure connection (*see, e.g.,* section a. on page 1 and page 3, paragraph 1 of Exhibit A).

3. As a more specific showing of correspondence, with reference to dependent claims 2 and 8, Figure 3 on page 3 of Exhibit A shows a self supporting member having a shorting pillar disposed between two feed pillars, and with reference to dependent claims 3-4 and 9-10, the self supporting member can be metallic or some form of metalised plastic (*see, e.g.,* page 3, paragraph 3 of Exhibit A).

I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.

Dated: February 10, 2009 Signature: K Boyle
Kevin Boyle

Sign Here

Attachment: Exhibit A (3 pages)

Exhibit A

Introduction

This patent proposal gives details of a method of more reliably implementing a "differentially-filled PIFA", as previously described in WS 248.

State of the Art (a.)

PIFA antennas are popular in mobile phones (Nokia use them almost exclusively, for example). The principal reasons for this are that:

- they exhibit low SAR performance (and less loss to the head)
- they are installed above the phone circuitry and, therefore, "re-use" the space within the phone to some degree

Such antennas normally mounted on the back of the phone's plastic cover and have feed and shorting tabs which extend down to the phone PCB. A typical dual-band configuration is shown in Figure 1.

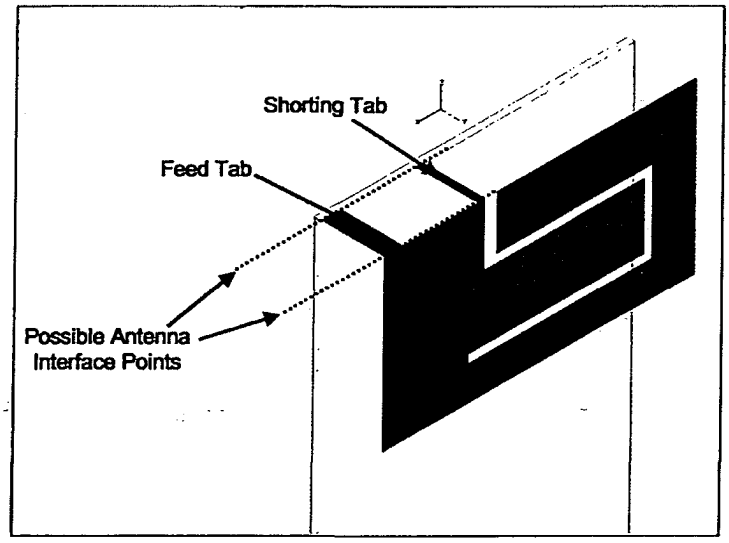

Figure 1 Typical PIFA Arrangement

A pressure connection is normally made either at the PCB or the interface with the antenna top plate. A supporting structure is normally required to reliably position the feed and shorting tabs (not shown).

The Problem (b.)

It has been shown in [1] that there are significant common and differential mode currents in the feed and shorting pins of conventional PIFAs. This put demands on the quality of the pressure connections of the feed and shorting pins, and also leads to loss in any nearby supporting structures.

Further, it has been shown in [2] that the gap between the feed and shorting pins can filled to form part of a bandwidth broadening resonant circuit. This tends to increase the circulating currents in the feed and shorting pins. The remainder of the resonant circuit (i.e., a discrete capacitor) is placed on

the PCB (or module) – hence the interface between the feed and shorting pins and the PCB becomes even more critical.

The Measures Proposed (c.)

To move the antenna interface such that all of the critical areas are part of the PCB or module. The feed and shorting pins become a small component that is part of the RF circuit and therefore well controlled. This component is self-supporting and, therefore does not suffer from losses associated with supporting structures. It is also directly soldered in a well-controlled, repeatable manner to the PCB or module, avoiding problems due to poor connections in combination with high currents. The antenna interfaces to this component at a point where differential mode currents are no longer present.

Embodiments (d.)

Figure 2 shows a dual-band, dual-fed PIFA design where the feed and shorting pins of the PIFA are implemented as a copper circuit component. Circulating currents are only present in the component, which makes the antenna interface less critical. Also only one connection to the antenna is required (rather than 3 if the interface were at the PCB).

The component itself can be self supporting, which eliminates losses due the support structure and allows standard, accurate pick and place soldering techniques to be used. In turn this allows much more accurate, repeatable fabrication of the resonant structure.

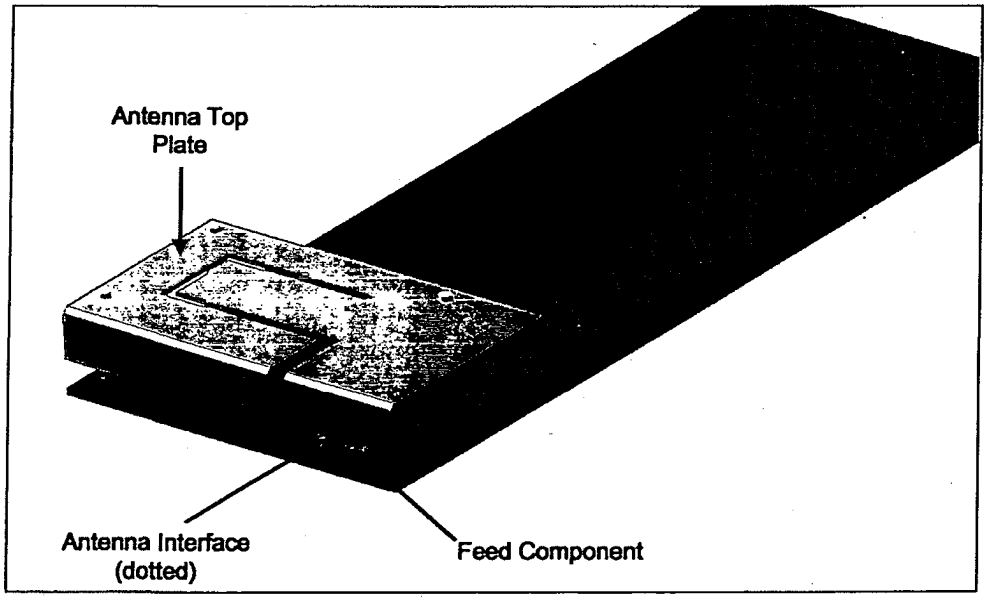

Figure 2 Dual-band, dual-fed antenna assembly with the antenna feed and shorting pins implemented as a circuit component

The feed component is shown in more detail in Figure 3.

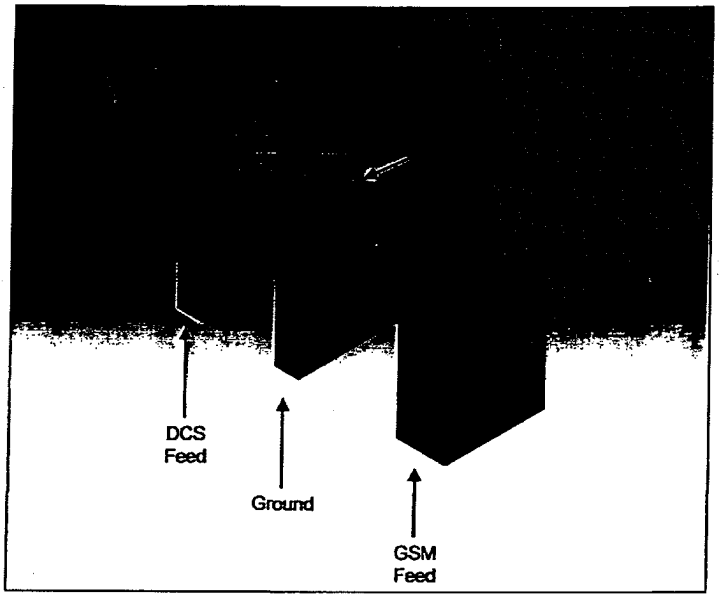

Figure 3 Detail of Dual-band Feed Component

It is likely that the antenna will interface to the component via a pressure connection. The large available area and lack of differential mode currents at this point improve the quality of this interface. Also, interfacing at this point improves the repeatability of the antenna impedance.

Though the description above is based on a dual-band, dual-fed design, the same principle can be used for single-band designs, when the component would have only two pillars, one for the feed and the other for ground.

The component can be purely metallic, or some form of metalised plastic, ceramic etc. Since the component is intended for use with resonating capacitors, it can be made of a metalised insulating material (ceramic, for example) such that the capacitance can be embedded in the component.

Fields of Application (e.)

Mobile communications. It is not necessarily restricted to PIFAs.

References

[1] Kevin Boyle, "Radiating and Balanced Mode Analysis of PIFA Shorting Pins", IEEE AP-S International Symposium and USNC/URSI National Radio Science Meeting, San Antonio, Texas, 16-21 June, 2002, Vol. 4, pp. 508 –511.

[2] K. R. Boyle, "Differentially Slotted And Differentially Filled PIFAs", Electronics Letters Vol. 39, No. 1, pp. 9-10, Jan, 2003.